Sprain of the neck

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Sprain of the neck: Quality of life and psychological functioning. A 4-year retrospective study

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Abstract

Aim of the study was to analyse quality of life and psychological functioning in patients with sprain of the neck, to analyse the relationship between complaints, quality of life, psychological functioning and personality factors, and to analyse the profile of patients with whiplash associated disorders (WAD), 4 years after trauma. From the University Hospital Groningen 193 patients with the diagnose sprain of the neck filled out a questionnaire. Of this group 100 subjects did not have complaints before the accident and were therefore at risk for the development of complaints as a result of sprain of the neck. Quality of life and psychological functioning were assessed using the RAND-36 and the SCL-90, respectively. Personality was assessed by means of the Dutch Personality Questionnaire. Of the group at risk (56% women and 44% men, mean age: 33.9, SD: 14.6) quality of life was significantly worse in subjects with complaints (mean: 78.4, SD: 15.5) compared to subjects without complaints (mean: 87.5, SD: 8.7). Psychological functioning did not differ significantly between the group with complaints compared to group without complaints. Personality did not differ between the groups. Personality and complaints together were significantly related to quality of life (r: 0.77) and psychological functioning (r: 0.85). No specific profile of WAD patients was found. In conclusion, personality and complaints influence quality of life and psychological functioning to a considerable extent.

Key words: Psychological functioning, Quality of Life (RAND 36), Sprain of the neck, Whiplash associated disorders

Introduction

Sprain of the neck is in the centre of attention of society and research because of the enormous impact on both the individual and western society. Many patients experience complaints after sprain of the neck even after a period of 4 years. About 77% of the subjects experience physical complaints and about 42% experience psychological complaints as a result of this type of injury [1].

Complaints (physical and/or psychological) after sprain of the neck, the so-called whiplash associated disorders (WAD) are very divers and may be disabling, resulting in loss of participation in domestic, social and professional activities. The economic impact of WAD on society is large due to medical costs and the costs of job disablement payment [2]. Complaints due to WAD may influence psychosocial functioning negatively. Further complaints due to WAD may influence quality of life negatively by loss of participation. Furthermore, psychosocial functioning and quality of life may be interrelated. Personality factors, as a trait of an individual, may influence perception of complaints, psychosocial functioning and quality of life.

In previous research the relationship between WAD and quality of life has been investigated

scarcely. Söderlund and Lindberg [3] found that WAD reduces quality of life related dimensions (physical functioning and psychosocial functioning) assessed by the sickness impact profile (SIP). Patients suffering from WAD were significantly more dysfunctional on the psychosocial sub-scales of the SIP than patients with rheumatoid arthritis. Contrastingly, on the physical sub-scale of the SIP the rheumatoid arthritis patients were more dysfunctional than the WAD patients. Compared to a norm population the WAD patients scored significantly worse on both physical- and psychosocial-sub-scales. Thus WAD patients seem to be dysfunctional physically as well as psychosocially. We must realise that the WAD patients were attending a 4-week multi-disciplinary pain program and may therefore be a subgroup of WAD patients with more than average pain problems. Furthermore, the SIP is not a specific quality of life assessment instrument. It assesses behaviourally based health status [4]. This is confirmed in a meta-analysis from Smith et al. [5] in which quality of life and health status turned out to be a different construct.

Psychosocial functioning in patients suffering from WAD has been investigated by several authors [3, 6, 7]. According to Söderlund, chronic WAD patients differ from other groups of patients in physical and psychosocial functioning, as mentioned above [3]. Wallis et al. [7] describe that subjects with whiplash associated headache suffer from psychological distress secondarily to their headache. These patients scored higher on all the sub-scales of the SCL-90-R, compared to patients with non-traumatic headache. Additionally, patients with whiplash associated headache scored above psychiatric diagnostic level, for the sub-scales somatisation, obsessive–compulsive, depression and hostility and the sum score of the psychological distress (global severity index). In an earlier study of Wallis and Bogduck [6], another psychological profile of WAD patients was found. This profile consisted of high scores (above psychiatric diagnostic level) of somatisation, obsessive–compulsive problems and depression. Hostility and the sum score of the psychological distress (global severity index) were not part of this profile.

The relationship between psychosocial factors and recovery after sprain of the neck was investigated by Radanov et al. [8] and Borchgrevink et al. [9]. Radanov et al. [8] found no significant differences between subjects with and subjects without disabling complaints with respect to personality characteristics and psychosocial stress assessed early after the injury. Similarly, Borchgrevink et al. [9] found that three subgroups of subjects suffering sprain of the neck (recovered, symptomatic and previously symptomatic) did not differ significantly on the sub-scales of the Millon Clinical Multiaxial Inventory (MCMI), a personality questionnaire. So, from the previous studies it can be concluded that: (1) personality factors do not influence the process of recovery after sprain of the neck, (2) that psychosocial dysfunctioning is considerable in patients with WAD and (3) a clear psychological profile still lacks.

The aims of this study were threefold: (1) to analyse differences in quality of life and psychological functioning between groups with and without complaints after sprain of the neck, (2) to search for a profile of patients with WAD and (3) to analyse the relationship between complaints, quality of life, psychological functioning and personality factors.

Material and methods

This 4 year retrospective study (1993–1997) involved all patients diagnosed with neck sprain according to the International Classification of Diseases (ICD-9 CM), who attended the Emergency Unit of the Department of Traumatology at the Groningen University Hospital (n = 655). The University Hospital Groningen is a 1056-bed centre situated in the north of the Netherlands; it serves a population of approximately 2 million people, which is about 93% of the catchment area. All trauma visits of both inpatients and outpatients are recorded on a standardised chart. Each case record comprises patient identification, external cause of injury, co-morbidity, trauma diagnoses, therapeutic procedures and other treatment characteristics. Sprains and strains of the neck were defined according to the N-code, 8th and 9th revision (code 847.0) of the International Classification of Diseases, which has been the same for the last 25 years. We defined the study population as victims with sprain of the neck due to car

accidents or to non-car accidents (such as accidental fall, sports, bicycle accidents).

This study was approved by the Medical Ethical Commission of the University Hospital Groningen. The study population was sent a questionnaire, which covered the following topics:

- Demographics: gender, age at the time of the accident.
- Self-reported physical and/or psychological complaints before the accident and currently experienced physical and/or psychological complaints for example pain in the head, neck, shoulders, arms, legs or back, feelings of anxiety, nervousness, tension, sadness, hostility etc.

The questionnaire is described in more detail elsewhere [1].

Additionally, quality of life was assessed using the Rand-36 also known as the SF-36, psychological functioning was assessed using the SCL-90 [10, 11]. The Rand-36 is a health related quality of life questionnaire assessing physical and social functioning, role limitations due to physical problems and due to emotional problems, vitality, mental health, pain, health perception and health change. These sub-scales all have a scoring range of 0–100.

Additionally quality of life was computed according to the rules Smith et al. [5] proposed: Quality of life = (1.6 × mental health) + physical functioning [5]. To create a scale range from 0 to 100 we divided the quality of life score by 2.6. A high score indicates a better-experienced health. Personality factors, inadequacy and social inadequacy, were assessed by using the two corresponding sub-scales of the Dutch Personality Questionnaire (DPQ). A high score on the sub-scales of the DPQ indicate more deviant behaviour. The DPQ is based on the Californian Psychological Inventory and has been adapted for the Dutch population. The 'Inadequacy' scale (21 items) included questions about vague physical complaints, depressed mood, non-specific anxiety and feelings of insufficiency. The scale can be considered as a measure of neuroticism. The 'Social inadequacy' scale (15 items) indicates the avoidance of or discomfort with social contacts. The scales have good test–retest reliability and validity research has confirmed their contents [12].

The scores on the scales of the SCL-90 were dichotomised into 'very high', and 'high' scores vs. 'above average' or 'lower' scores according to the criteria for the 'normal population' of the Dutch SCL-90 manual, corrected for gender [11]. A high score indicates a worse experienced psychological functioning. The scores of the DPQ sub-scales were dichotomised into 'above average' or 'higher' scores and 'average' or 'lower' scores also according to the Dutch manual [12].

The total numbers of physical complaints (maximum of nine) and of psychological complaints (maximum of 13) were entered in the data base.

Data analysis, in SPSS version 9 for Windows, included: descriptive statistics, χ^2, *t*-test for independent samples and Pearson's product–moment correlation. Confidence Interval Analysis (CIA, version 2) was used to calculate the 95% confidence intervals of the differences between groups. Regression analyses was used to predict quality of life and psychological complaints. Age and gender entered stepwise forward into the equation in the first block, because we wanted to correct the estimation for age and gender. Number of complaints, inadequacy and social inadequacy were respectively entered stepwise forward in the second block.

Results

The database provided 655 potential patients for this study who were sent a questionnaire. Of 12 patients the address was unknown. Of the 643 patients, 35 reported that they had not suffered from a sprain of the neck, 11 patients did not want to participate, 12 patients had died, 77 moved without leaving an address. Thus potentially our database consisted of 508 patients. The response was 193 (37%). The Medical Ethical Commission of our hospital did not approve to contact the non-responders. Privacy and protection of patients is an important issue in the protocols the Medical Ethical Commission. Characteristics of the non-responders (315) and the responders (193) are summarised in Table 1. Of the responders 93 subjects had complaints before the accident and 100 had no complaints (neither physical nor psychological) before the accident. Thus these 100 subjects were at risk for developing complaints as a result of the sprain of the neck (Table 1).

Table 1. Characteristics of the non-responders (515) and the responders (193)

	Non-responders	Responders	Responders with complaints before the accident	Responders without complaints before the accident
Age at the time of accident: mean (SD)	32.2 (15.7)	36.6 (14.4)[a]	39.7(13.7)	33.9 (14.6)[b]
Follow-up: mean (SD)	4.6 (1.2)	3.9 (1.8)[c]	3.8 (2.1)	4.0 (1.5)
Gender				
Female	148 (47%)	116 (62%)[d]	58 (67%)	54 (56%)
Male	167 (53%)	70 (38%)	28 (33%)	42 (44%)
Accident				
Car	–	153 (80%)	70 (81%)	79(79%)
Other	–	37 (20%)	16 (19%)	21(21%)

The responders are divided in a group with complaints before the accident and a group without complaints before the accident. Because not all participants completed the total questionnaire the number of subjects do not ad up to 193.

[a] Difference in mean age at the time of the accident differed significantly ($p = 0.016$), between responders and non-responders, results of t-test for independent samples.

[b] Difference in mean age at the time of the accident differed significantly ($p = 0.008$) between the responders with complaints and without complaints before the accident, results of t-test for independent samples.

[c] Difference in follow-up accident differed significantly ($p = 0.001$), between responders and non-responders, results of t-test for independent samples.

[d] Difference in gender differed significantly ($p = 0.003$), between responders and non-responders, results of χ^2 test.

In Table 2 the mean scores of the total group on the sub-scales of the RAND-36 are summarised. For comparison, the mean values of the RAND-36 of a Dutch reference group are added to Table 2. The group with sprain of the neck scored significantly worse than the reference group for all scales of the RAND-36 except for physical functioning, health change, and role limitations due to emotional problems. Besides these statistical differences the mean differences exceeded 10 on the scales social functioning, role limitations due to physical problems, and vitality. The difference between the group with sprain of the neck and the reference group exceeded more than 20 for health perception. No quality of life score is available for the reference group.

Of the group without complaints before the accident (the group at risk for developing complaints because of the sprain of the neck), the mean scores of the group with complaints and without complaints after the accident are summarised in Table 3. The group with complaints scored sig-

Table 2. Mean scores of the total group (n = 193) and a reference group on the scales of the RAND-36

RAND-36	Group with sprain of the neck		Reference group		Difference	(95% CI)
	0	SD	0	SD		
Physical functioning	79.6	22.5	81.9	23.2	2.3	(−1.2 to 5.8)
Social functioning	72.8	26.8	86.9	20.5	14.1*	(10.8 to 17.4)
Role limitation (phys)	60.5	42.4	79.4	35.5	18.9*	(13.3 to 24.5)
Role limitations (emo)	79.4	35.5	84.1	32.3	4.7	(−0.3 to 9.7)
Vitality	55.1	21.9	67.4	19.9	12.3*	(9.2 to 15.4)
Mental health	72.0	18.0	76.8	18.4	4.8*	(2.0 to 7.6)
Pain	70.8	25.4	79.5	25.6	8.7*	(4.8 to 12.6)
Health perception	49.3	10.3	72.7	22.7	23.4*	(20.1 to 26.7)
Health change	50.7	22.9	52.4	19.4	1.7	(−1.4 to 4.8)
Quality of life	74.7	16.7		Not available		

The reference group was composed of a random sample (n = 1063) of inhabitants of Emmen, a city in the north of the Netherlands. When the 95% confidence interval for the estimated difference between the groups does not include zero the results are significant at the 0.05 level (marked with *).

Table 3. Comparison between subjects with (n = 76) and without complaints (n = 22) after the accident of the group at risk for developing complaints (n = 98)

RAND-36	With complaints		Without complaints		Difference	(95% CI)
	0	SD	0	SD		
Physical functioning	83.6	18.0	96.6	7.8	13.0*	(5.2 to 20.8)
Social functioning	77.2	25.8	93.8	10.7	16.6*	(5.4 to 27.8)
Role limitations (phys)	63.7	43.2	90.5	25.6	26.8*	(7.5 to 46.0)
Role limitations (emo)	81.8	35.6	100.0	0.0	18.2*	(3.1 to 33.3)
Vitality	56.4	24.0	73.8	16.0	17.4*	(6.6 to 28.2)
Mental health	75.3	17.6	81.8	13.3	6.5	(−1.6 to 14.6)
Pain	72.5	25.4	93.6	13.0	21.1*	(9.9 to 32.3)
Health perception	50.1	9.8	50.2	11.7	0.1	(−4.8 to 5.0)
Health change	53.0	22.3	53.4	16.0	0.4	(−9.7 to 10.5)
Quality of life	78.4	15.5	87.5	8.7	9.1*	(3.9 to 14.2)

Because not all subjects completed the total questionnaire the totals do not add up to (n = 100).
The higher the scores on the sub-scales, the better the experienced quality of life is.
When the 95% confidence interval for the estimated difference between the groups does not include zero the results are significant at the 0.05 level (marked with *).

nificantly worse than the group without complaints, except for the sub-scales mental health, health perception and health change. Besides these statistical differences the mean differences exceeded 10 points on all sub-scales except for mental health, health perception and health change. For six scales the differences between the means exceeded 10 points, of which two scales, pain and role limitations due to physical functioning, exceeded 20 points. Furthermore, the mean scores of the group without complaints after the accident had considerably higher scores on the scales of the RAND-36 than the reference group, except for health perception and health change (Table 2). Quality of life was significantly worse in the group with complaints (Table 3).

The percentages and number of subjects of the total group with a 'high' or 'very high' score on the sub-scales and the sum score of the SCL-90 are summarised in Table 4 as well as the number and percentages of subjects with an above average score on the two sub-scales of the DPQ. The percentages of subjects with a 'high' or a 'very high' score on the sub-scales of the SCL-90 are considerable: 22% for anxiety up to 37% for depression.

Of the subjects without complaints before the accident (group at risk for developing complaints), the percentages and the number of subjects with a high score on the scales of the SCL-90 and with an above average score on two sub-scales of the DPQ are summarised in Table 4. The percentages of subjects with a high or a very high score on the SCL-90 in subjects with and without complaints after the accident did not differ significantly. The percentages of subjects with an above average score on two sub-scales of the DPQ in subjects with and without complaints after the accident were similar.

Complaints were moderately correlated with quality of life ($r = -0.59$; $p \leqslant 0.01$), inadequacy ($r = 0.44$; $p \leqslant 0.01$) and psychological functioning (SCL-90 sum score) ($r = 0.58$; $p \leqslant 0.01$). Psychological functioning (SCL-90 sum score) was strongly correlated with quality of life and inadequacy, ($r = -0.74$; $p \leqslant 0.01$) and ($r = 0.81$; $p \leqslant 0.01$) respectively. Quality of life was considerably correlated with inadequacy ($r = -0.70$; $p \leqslant 0.01$).

In the prediction of quality of life and psychological functioning, inadequacy and number of complaints contributed significantly. The influence of inadequacy was both in quality of life and psychological functioning the strongest (explained variance 47 and 63%, respectively) (Table 5).

An overview of the psychological profiles found is given in Table 6 [7]. Five of the eight sub-scales are in concordance: both Wallis and Versteegen found a triad of complaints (depression, somatisation and insufficiency) and no scores above psychiatric level on the sub-scales anxiety and sensitivity.

Table 4. Percentage of 'high' or 'very high' scores on the sub-scales of the SCL-90 and the 'above average' score on the two sub-scales of the DPQ of the total group (n = 193) and of the groups with (n = 74) and without complaints (n = 20) after the accident of the group at risk

SCL-90 (High or very high score)	Total group N = 193	Group at risk N = 94		
	% (N)	With complaints N = 74	Without complaints N = 20	*p*
Agoraphobia	30% (54)	24% (18)	20% (4)	NS
Anxiety	22% (40)	18% (13)	5% (1)	NS
Depression	37% (65)	23% (17)	20% (4)	NS
Somatisation	32% (59)	26% (19)	5% (1)	NS
Insufficiency	35% (64)	30% (22)	15% (3)	NS
Sensitivity	23% (41)	15% (11)	10% (3)	NS
Hostility	33% (60)	28% (21)	10% (2)	NS
Insomnia	28% (50)	20% (15)	20% (4)	NS
Sum score	31% (56)	20% (15)	10% (2)	NS
DPQ (above average)				
Inadequacy	24% (43)	16% (12)	15% (3)	NS
Social inadequacy	21% (38)	14% (10)	15% (3)	NS

The cut off point for high and very high for the SCL-90 and the above average score on the two sub-scales of the DPQ are corrected for gender in the Dutch population. *p*-Values are the results of the χ^2 with a continuity correction. Because not all subjects completed the total questionnaire the totals do not add up to (n = 100).
In the Dutch population 20% of the subjects have high or very high scores on the SCL-90 sub-scales. Additionally 20% of the subjects in the Dutch population have an above average score on the DPQ.
The sub-scales of the SCL-90 somatisation, depression, anxiety, hostility, have the same construct and name in the English and Dutch language version. With respect to the construct the sub-scale insufficiency (Dutch version) is comparable with the sub-scale obsessive compulsive (English version), agoraphobia (Dutch version) is comparable with phobic anxiety (English version) and the sum score of emotional instability (Dutch version) is comparable with the global severity index (English version). The sub-scales sensitivity, insomnia and additional items are not comparable however they contribute to the sum score.

Table 5. Results of the linear regression analysis to predict quality of life and the SCL-90 sum score (psychoneuroticism) for the group at risk on the basis of gender, age, and number of complaints, inadequacy and social inadequacy

Variable	*b*	95% CI of *b*	R^2 change	R^2 sum
Quality of life				
Gender	0.1	−4.0 to 4.3		
Age	−0.1	−0.3 to 0.06	0.02	
Inadequacy	−1.1	−1.4 to −0.8	0.47	
Number of complaints	−1.3	−1.9 to −0.7	0.10	
Constant	97.6	90.4 to 104.9		
				0.60
SCL-90 sum score				
Gender	5.0	−3.5 to 13.5		
Age	0.1	−0.2 to 0.4	0.04	
Inadequacy	3.4	2.8 to 4.1	0.63	
Number of complaints	2.5	1.3 to 3.6	0.06	
Constant	79.1	64.2 to 94.0		
				0.73

Discussion

After sprain of the neck the quality of life is considerably reduced compared to a reference group and psychological functioning is considerably poorer compared to the Dutch population. Generally speaking, when looking at the large differences between the groups with and without complaints it can be seen that the poorer quality of life can be attributed to having complaints after sprain of the neck. Clinically these results indicate that the subjects suffering from sprain of the neck resulting in WAD have a quality of life which is lower than a reference group. These differences in quality of life, are not only statistically significant but are considerable, more than 10 on a scale range of 0–100, for the scales social functioning, role limitations due to physical problems, vitality, and health perception. Remarkably, physical functioning does not differ significantly between the reference group and the group with sprain of

Table 6. Overview of profiles of the patients with WAD on the SCL-90

	Wallis (1998) WAHeadache group	Wallis (1996) WAD group	Versteegen group with complaints
Agoraphobia	–	–	+
Anxiety	–	–	–
Depression	+	+	+
Somatisation	+	+	+
Insufficiency	+	+	+
Sensitivity	–	–	–
Hostility	+	–	+
Insomnia	–	–	+
Sum score	+	–	+

WA headache – whiplash associated headache; WAD – whiplash associated disorders.
The sub-scales of the SCL-90 somatisation, depression, anxiety, hostility, have the same construct and name in the English and Dutch language version. With respect to the construct the sub-scale insufficiency (Dutch version) is comparable with the sub-scale obsessive compulsive (English version), agoraphobia (Dutch version) is comparable with phobic anxiety (English version) and the sum score of emotional instability (Dutch version) is comparable with the global severity index (English version). The sub-scales sensitivity, insomnia and additional items are not comparable however they contribute to the sum score.

the neck whereas role limitations due to physical problems differs considerably. Thus two groups with a similar physical functioning differ considerably with respect to the experienced physical functioning and the resulting role limitations. These discrepancies may be explained by a selective perception of complaints, attribution of complaints to the accident or illness behaviour in the group with sprain of the neck. These discrepancies are supported by the large difference in vitality and health perception between the groups. Contrastingly the difference in pain is significant but rather small between the groups. The poorer social functioning in the group with sprain of the neck may be explained by the experienced role limitations due to physical problems.

Strangely, health perception is similar in the group with and the group without complaints after the accident, whereas one expects health perception to be better in the group without complaints. Interestingly, compared to the reference group, the group without complaints after the accident have remarkable high scores on the sub-scales of the RAND 36, except for health change (almost similar in both groups) and health perception (considerably lower than the reference group).

With respect to the psychological functioning of patients with sprain of the neck, assessed by the SCL-90, a 'high' or a 'very high' score is considerable (22% for anxiety up to 37% for depression). In the Dutch population 20% of the subjects have high or very high scores on the SCL-90 sub-scales. Thus the percentage of subjects with a high or very high score in the group with sprain of the neck is considerably larger (10% compared to the percentile scores of the Dutch population) for all sub-scales except for anxiety, sensitivity and insomnia.

Comparing the groups with and without complaints after the accident (of the group at risk), it can be seen that the differences in percentage of subjects with a very high or a high score do not differ significantly between the groups. It must be noted, however, that the percentage of subjects in the group with complaints with a high or very high score is higher for all sub-scales of the SCL-90 except insomnia. When comparing our results with the results of Wallis and Bogduk [6] according to the same scale constructs, we also found in the sub-scales depression, somatisation and insufficiency a large percentage of patients of our population scored above diagnostic level. However, we found also a large percentage of patients with an above diagnostic level for the sub-scales agoraphobia, anxiety, hostility and sum score. These findings are similar with the whiplash associated headache group (Wallis 1998) except for the sub-scale anxiety.

The percentage of subjects with an above average score on the inadequacy scales of the Dutch Personality Inventory (the DPQ) do not differ from the Dutch norm of the normal population. A typical profile of personality traits could not be found in previous studies [8, 9]. However, we found that 'inadequacy' was significantly correlated with number of complaints, psychological functioning and quality of life in patients suffering from WAD.

We only used two sub-scales of the DPQ, these scales give an impression of the personality trait 'neuroticism'. Neuroticism is intimately linked to health habits, somatic complaints, illness behaviour and medical diagnosis [13]. An individual with a neurotic personality will be liable particularly to suffer from stress after a trauma (sprain of the neck) and therefore may develop complaints [14].

Our findings of an older age for subjects with complaints after the accident is in agreement with the findings of others [8, 9]. Also the female predominance in the group with complaints after the accident is in agreement with other studies [15, 16]. Versteegen et al. [17] also found a female predominance in the total group of subjects with sprain of the neck. It must be noted that also in the group without complaints after the accident there is also a female predominance. This predominance can be explained by the phenomenon that women tend to report more complaints [18, 19].

A limitation of our study is its retrospective character. Recall bias may be present, patients may not remember exactly whether they had complaints before the accident (average 4 years ago). However, retrospective research provides suggestions for prospective studies. Other limitations of our study are problems that characterise self-report measures: the biases on the part of the subject and the lack of evidence that the measure assesses the characteristic of interest. But, self-report measures are designed to measure specific subject characteristics and specific aspects of a domain of functioning and are therefore very popular. An advantages of this type of assessment is that many states, feelings and psychological problems are defined by what clients see or feel. Furthermore, self-report measures permit assessment of several domains of functioning that are not available with other assessment techniques [20].

The response in our study was 37%, which may have consequences for our outcome. It is possible that of the subjects with complaints a larger number returned the questionnaire as compared to subjects without complaints. In that case our findings are biased towards an over estimation of complaints. It is not clear which effect this might have on the relationships we found. An overestimation of complaints is possible because more women participated in the study and women have the tendency to report more complaints [19]. However, in a prospective study non-response may still be associated with perceived complaints. Future research is needed to confirm or to reject our model.

Quality of life was calculated from the scores mental health and physical functioning of the RAND-36, according to Smith et al. [5]. We therefore were able to compose a quality of life score from the RAND 36, which is basically a questionnaire assessing general health status.

With respect to the model we presented in the introduction, we found that the number of complaints have a considerable impact on quality of life and psychological functioning. Quality of life and psychological functioning are interrelated to a considerable extend. Inadequacy as a part of personality was strongly related to psychological functioning, and was considerably related with quality of life. Inadequacy was moderately related to complaints.

In conclusion quality of life of patients with sprain of the neck of considerably reduced compared to a reference group. Psychological functioning is worse compared to the Dutch (norm) population. No univocal profile of patients with WAD was found. We did found a triad of the scales depression, somatisation and insufficiency. Complaints have a considerable impact on quality of life and psychological functioning. Quality of life and psychological functioning are interrelated to a considerable extent. Inadequacy as a part of personality was related to psychological functioning, to quality of life and complaints.

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